WHAT IS CLAIMED IS:

1. An optical repeater, comprising:

a demultiplexer for dividing an inputted light into two components;

a semiconductor optical amplifier including an active layer that has one type of structure selected from a group composed of a quantum dot, a quantum wire, a quantum dash, and a quantum well, and amplifying respective components of a light outputted from said demultiplexer; and

a multiplexer for coupling two components of a light outputted from said semiconductor optical amplifier.

2. The optical repeater according to claim 1, wherein said demultiplexer is a polarization beam splitter for dividing the inputted light into two components that are orthogonal to each other.

3. The optical repeater according to claim 1, wherein said demultiplexer divides the inputted light into a TE wave and a TM wave.

4. The optical repeater according to claim 1, wherein said demultiplexer and said multiplexer are monolithically integrated with said semiconductor optical amplifier.

5. The optical repeater according to claim 1, wherein said demultiplexer and said multiplexer are integrated as a PLC with said semiconductor optical amplifier.

6. The optical repeater according to claim 1, further comprising:

a variable optical attenuator for attenuating a light outputted from said multiplexer;

an output detector for detecting an intensity of a light outputted from said variable optical attenuator; and

an output controller for controlling an intensity of an output signal by controlling operation of said variable optical attenuator based on the intensity detected by said output detector.

7. The optical repeater according to claim 1, further comprising:

an input detector for detecting an intensity of the inputted light;

a variable optical attenuator for attenuating a light outputted from said multiplexer;

an output detector for detecting an intensity of a light outputted from said variable optical attenuator; and

a gain controller for controlling a gain by controlling operation of said variable optical attenuator based on the intensity detected by said input detector and the intensity detected by said output detector.

8. An optical repeater, comprising:

a demultiplexer for dividing an inputted light into a TE wave and a TM wave;

a converter for converting the TM wave into a TE wave;

a multiplexer for coupling a TE wave outputted from said demultiplexer and a TE wave outputted from said converter; and

a semiconductor optical amplifier including an active layer that has one type of structure selected from a group composed of a quantum dot, a quantum wire, a quantum dash, and a quantum well, and amplifying a light outputted from said multiplexer.

9. The optical repeater according to claim 8, further comprising a phase controller for controlling a phase of the TE wave outputted from said demultiplexer so that the TE wave intensifies with a TE wave outputted from said converter in said multiplexer.

10. The optical repeater according to claim 8, wherein said demultiplexer, said converter and said multiplexer are monolithically integrated with said semiconductor optical amplifier.

11. The optical repeater according to claim 8, wherein said demultiplexer, said converter and said multiplexer are integrated as a PLC with said semiconductor optical amplifier.

12. The optical repeater according to claim 8, further comprising:

a variable optical attenuator for attenuating a light outputted from said semiconductor optical amplifier;

an output detector for detecting an intensity of a light outputted from said variable optical attenuator; and

an output controller for controlling an intensity of an output signal by controlling operation of said variable optical attenuator based on the intensity detected by said output detector.

13. The optical repeater according to claim 6, wherein said variable optical attenuator and said output detector are monolithically integrated with said semiconductor optical amplifier.

14. The optical repeater according to claim 12, wherein said variable optical attenuator and said output detector are monolithically integrated with said semiconductor optical amplifier.

15. The optical repeater according to claim 6, wherein said variable optical attenuator and said output detector are integrated as a PLC with said semiconductor optical amplifier.

16. The optical repeater according to claim 12, wherein said variable optical attenuator and said output detector are integrated as a PLC with said semiconductor optical amplifier.

17. The optical repeater according to claim 8, further comprising:

an input detector for detecting an intensity of the inputted light;

a variable optical attenuator for attenuating a light outputted from said multiplexer;

an output detector for detecting an intensity of a light outputted from said variable optical attenuator; and

a gain controller for controlling a gain by controlling operation of said variable optical attenuator based on the intensity detected by said input detector and the intensity detected by said output detector.

18. The optical repeater according to claim 7, wherein said input detector, said variable optical attenuator and said output detector are monolithically integrated with said semiconductor optical amplifier.

19. The optical repeater according to claim 17, wherein said input detector, said variable optical attenuator and said output detector are monolithically integrated with said semiconductor optical amplifier.

20. The optical repeater according to claim 7, wherein said input detector, said variable optical attenuator and said output detector are integrated as a PLC with said semiconductor optical amplifier.

21. The optical repeater according to claim 17, wherein said input detector, said variable optical

attenuator and said output detector are integrated as a PLC with said semiconductor optical amplifier.

22. The optical repeater according to claim 1, further comprising a gain equalizer for controlling a gain of a light outputted from said semiconductor optical amplifier within a range within a predetermined wavelength band.

23. The optical repeater according to claim 8, further comprising a gain equalizer for controlling a gain of a light outputted from said semiconductor optical amplifier within a range within a predetermined wavelength band.

24. The optical repeater according to claim 22 wherein said gain equalizer is integrated on a semiconductor substrate with said semiconductor optical amplifier.

25. The optical repeater according to claim 23 wherein said gain equalizer is integrated on a semiconductor substrate with said semiconductor optical amplifier.

26. The optical repeater according to claim 1 wherein said optical repeater is used as a 1R repeater.

27. The optical repeater according to claim 8 wherein said optical repeater is used as a 1R repeater.